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Enhancing the Context of X-ray Fluorescence Imaging: Highlights from the Redevelopment of Beamline 8-BM

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The development of x-ray fluorescence (XRF) microscopy has opened a new window into the role of trace metals in the life and environmental sciences. While very successful, this approach is severely limited in the scope of study due to the time necessary to acquire statistically significant data in a scanning microprobe, in particular for low-probability events. We are now developing an existing bending magnet beamline (8-BM) into a dedicated beamline for the high-throughput analysis of trace elements in the life sciences. We are commissioning dedicated instrumentation that allows the high-throughput analysis of micro-arrays and tissue sections to improve our understanding of trace metals and their essential role in health and disease. In particular, the instrumentation will enable the rapid acquisition of large data sets necessary for clinically relevant interpretation. We will also incorporate x-ray cytometry to study the total trace element composition of single cells in order to examine large cell populations on an individual basis, enabling experiments with a large scope that are currently not possible. Lastly, by combining XRF with both traditional and cutting-edge proteomics technologies, we will enable unprecedented scientific inquiry into metal mediated regulation of biological pathways.